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IW And IS A Z Cam-TYPE DWARF NOVA

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IW And (S 10792) was a blue variable discovered by Meinunger (1975). Meinunger (1980) studied the object spectroscopically and described that the object seems to be a unique object: in spite of broad absorption lines of Hβ, Hγ and Hδ resembling those of an O or early B dwarf or subdwarf, the spectrum was found to be featureless around Hα. Meinunger (1980) further stated that a couple of doubtful emission lines at the limit of detectability seem to be present. From 330 observations for the period JD 2440802–46706, Meinunger, Andronov (1987) found that the object spends 72% of time in an "inactive" state (15.1–15.3 mag). The object infrequently showed maximum brightness (18% of time, 13.7–15.0 mag) and minimum brightness (10% of time, 15.4–17.3 mag). Meinunger, Andronov (1987) stated that such behavior is significantly different from those of dwarf novae or polars. More recently, Liu et al. (1999) obtained a higher quality spectrum, and detected Hα emission line with broad absorption troughs. Although Liu et al. (1999) classified the object as a confirmed cataclysmic variable, the exact nature of the object has not been evident owing to the lack of dense photometric observations.

We observed IW And on 55 nights between 2001 December 6 and 2002 March 25. The observations were done using an unfiltered ST-7E camera (system close to R_c) attached to the Meade 25-cm Schmidt-Cassegrain telescope. The exposure time was 30 s. The images were dark-subtracted, flat-fielded, and analyzed using the Java^{TM}-based PSF photometry package developed by on of the authors (TK). The differential magnitudes of the variable were measured against GSC 2811.1573 (Tycho-2 V-magnitude 12.05, $B-V$=0.11), whose long-term constancy was confirmed to 0.10 mag by comparison with GSC 2811.2117 (Tycho-2 V-magnitude 11.57, $B-V$=0.69). The log of observations is summarized in table 1.

The resultant light curve is shown in Fig. 1. The light curve clearly shows a damping oscllation at the beginning of the observation. After that, the object entered a standstill. The behavior is quite characteristic to a Z Cam-type dwarf nova entering a standstill (Szkody, Mattei 1984; Honeycutt et al. 1998; Kato 2001). There was even a small hint of small-amplitude oscillations during the early part of the standstill which are quite analogous to those of Z Cam (Kato 2001) and HX Peg (Honeycutt et al. 1998). The last observation may indicate that the object was caught during an outburst from the standstill. The present observation established that IW And is a previously unrecognized

Table 1. Nightly averaged magnitudes of IW And

Mid-JD[a]	Mean mag[b]	Error[c]	N^d	Mid-JD[a]	Mean mag[b]	Error[c]	N^d
52250.1090	2.224	0.005	31	52305.8840	2.794	0.014	31
52250.9993	1.973	0.006	31	52306.8847	2.721	0.017	31
52252.1208	1.967	0.007	31	52309.9958	2.675	0.037	10
52255.1118	2.215	0.017	31	52311.8993	2.846	0.024	31
52255.9875	2.325	0.043	12	52312.8972	2.786	0.030	31
52257.0632	2.688	0.044	31	52316.9007	2.675	0.010	31
52257.9840	3.293	0.013	31	52317.8951	2.713	0.019	31
52259.9757	4.398	0.048	31	52318.8986	2.639	0.017	31
52260.9667	4.686	0.067	31	52319.8931	2.591	0.031	31
52261.9993	4.908	0.094	31	52320.9243	2.647	0.012	31
52262.9660	4.415	0.034	31	52323.9382	2.887	0.179	5
52266.9660	3.366	0.022	31	52325.9062	2.738	0.014	31
52267.9562	4.186	0.043	31	52327.9569	2.659	0.039	31
52270.9486	5.017	0.119	31	52329.9188	2.866	0.013	31
52276.9639	2.753	0.021	29	52330.9021	2.852	0.032	31
52277.9076	2.985	0.010	31	52336.9167	2.802	0.028	31
52279.0493	3.347	0.159	6	52337.9062	2.732	0.044	26
52282.9604	2.589	0.011	31	52341.9042	2.718	0.036	18
52286.9056	2.741	0.012	31	52342.9590	2.817	0.041	12
52291.9104	2.852	0.042	31	52344.9076	2.875	0.046	31
52293.8875	2.753	0.012	31	52345.9132	2.770	0.041	31
52296.8764	2.641	0.013	31	52346.9090	2.672	0.036	31
52297.8875	2.704	0.027	31	52348.9111	2.800	0.087	19
52298.8861	2.748	0.017	31	52351.9181	2.728	0.031	31
52301.9292	2.767	0.026	31	52352.9146	2.619	0.051	31
52302.9847	2.769	0.038	31	52353.9153	2.829	0.079	20
52303.8979	2.813	0.021	31	52358.9181	2.121	0.030	22
52304.9639	2.858	0.024	31				

[a] JD−2400000.

[b] Relative magnitude to GSC 2811.1573.

[c] Standard error of nightly average.

[d] Number of frames.

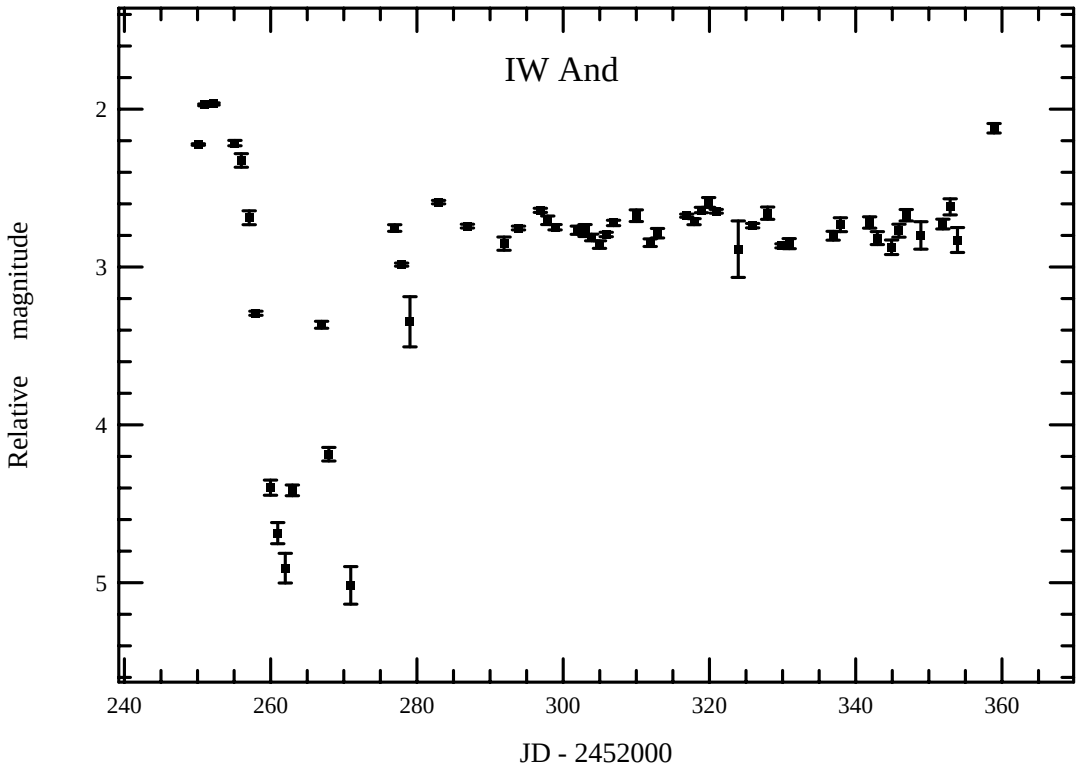

Figure 1. Light curve of IW And

Z Cam-type dwarf nova. The "inactive" state described in Meinunger, Andronov (1987) must have been standstills.

Among Z Cam stars, the duty cycle (nearly 72%) of standstills is exceptionally high (cf. the largest duty cycle of well-observed Z Cam stars is 45% Oppenheimer et al. 1998). Although Z Cam stars have long been understood as intermediate systems between dwarf novae and novalike (NL) systems (e.g. Meyer, Meyer-Hofmeister 1983) in the framework of the disk-instability model (see Osaki 1996 for a review), there has been a wide gap between Z Cam stars and NL systems in terms of the duty cycle of standstills, which are equivalent to a thermally stable state of NL systems. IW And is apparently the first object to fill this gap with its large duty cycle of standstills. Since such an object is expected to be provide strong observational constraints to the mechanism of Z Cam stars (Meyer, Meyer-Hofmeister 1983, Honeycutt et al. 1998, Buat-Ménard et al. 2001), further continuous observations to precisely determine the pattern of outbursts and standstills, and spectroscopic observations to determine system parameters (orbital period, component masses etc.) are strongly encouraged.

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